higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

PLANT OPERATION THEORY N1

2 August 2021

This marking guideline consists of 5 pages.

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QUESTION 1: CHEMISTRY

1.1.1 A

1.1.2 C

1.1.3 C

1.1.4 A

1.1.5 B (5 × 1) (5)

1.2
- They are soft metals with low melting points.
- They react with oxygen to form oxides.
- They react with water and liberate hydrogen.
- Their activity increases from top to bottom in the group.
- They form oxides with the same basic formula. (5)

1.3
1.3.1 4
1.3.2 6
1.3.3 2
1.3.4 5
1.3.5 1

(5 × 1) (5)

1.4 Mr (1 + 35 + 23 + 16 + 1)✓ = (23 + 35,5 + 2 + 16)✓
35,5 + 40✓ = 58 + 18✓
76,5 g/mol = 76,5 g/mol✓ (5)

[20]

QUESTION 2: PIPES AND VALVES

2.1 They can handle temperatures of up to 260 ºC. They are relatively cheaper than other types of pipes.✓ The disadvantages are that they can burn and become brittle at low temperatures.✓ They are also not shock-resistant.✓ These pipes are used to handle chemicals.✓ (4)

2.2
- To regulate flow
- To check back-flow
- To regulate pressure
- To relieve pressure (4)

2.3
- The carbon provides strength and other properties lacking in pure iron.✓✓
- The quality is high when in the vicinity of 2%.✓ (3)

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2.4
- Adjusting screw
- Spring
- Bonnet
- Disc holder
- Seat disc/valve seating
- Body
- Blow-down adjusting screw
- Nozzle/Tank (8)

2.5
- The valve seating may be damaged, allowing liquid to pass through.
- The valve is the wrong size or is not fully closed due to, for example, dirt or debris. (3)
- Excessive force is exerted on the stopper by the process operator.

[22]

QUESTION 3: PUMPS AND INSTRUMENTATION

3.1
- Quantity (mass) that has to be displaced by the pump
- Distance or height to which it has to be displaced
- Time in which it has be done
- Supply pressure (4 × 1) (4)

3.2
- Open-vane impellers are suitable for fluids containing solids, e.g. sewage.
- Semi-closed or web impellers are used to handle fluids or products containing solids.
- Open-sided or ribbed impellers are excellently suited for pumping water containing fibrous materials.
- Closed or shielded impellers are popular for all types of centrifugal pumps.

(4 × 2) (8)

3.3 3.3.1 $P = W \div t$

$$= \frac{180\,000\ kg \times 9{,}81 \times 5}{45 \times 60}$$ ✓✓

$= 3{,}3\ kW$ ✓✓ (4)

3.3.2 $\text{Efficiency} = \frac{\text{output}}{\text{input}} \times 100\%$

$= \frac{3{,}27}{8}$ ✓

$= 41\%$ ✓ (2)

3.4 A vacuum is a region where the gaseous pressure is much lower than the atmospheric pressure. It can be measured with a Bourdon tube pressure gauge or a U-tube differential manometer.

(2)
[20]

QUESTION 4: DISTILLATION AND WATER TREATMENT

4.1 Calcium sulphate, magnesium sulphate, limestone, calcium carbonate (4)

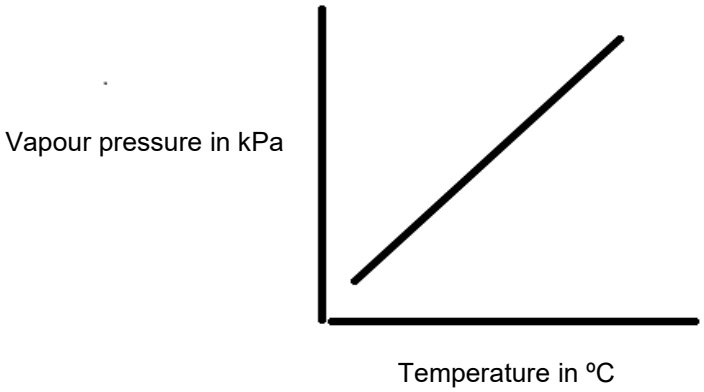
4.2 4.2.1 Solids such as clay, silt, mud and organic solids (e.g. leaves) that are insoluble in water

4.2.2 The process of removing all the dissolved salts and ions from water

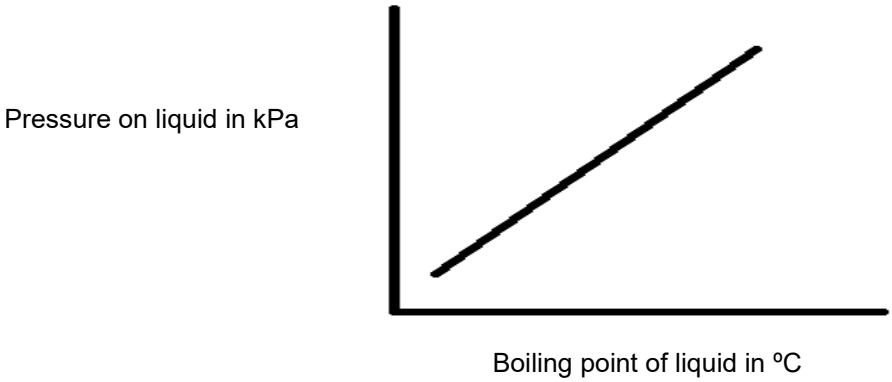
4.2.3 Water that is neither corrosive nor scaling

(3 × 2) (6)

4.3 Liquid will boil when the vapour pressure exceeds the pressure on the fluid.✓ The higher the pressure, the higher the boiling point.✓✓✓



Should the pressure or the temperature change,✓ the rate of evaporation will also change.✓✓✓



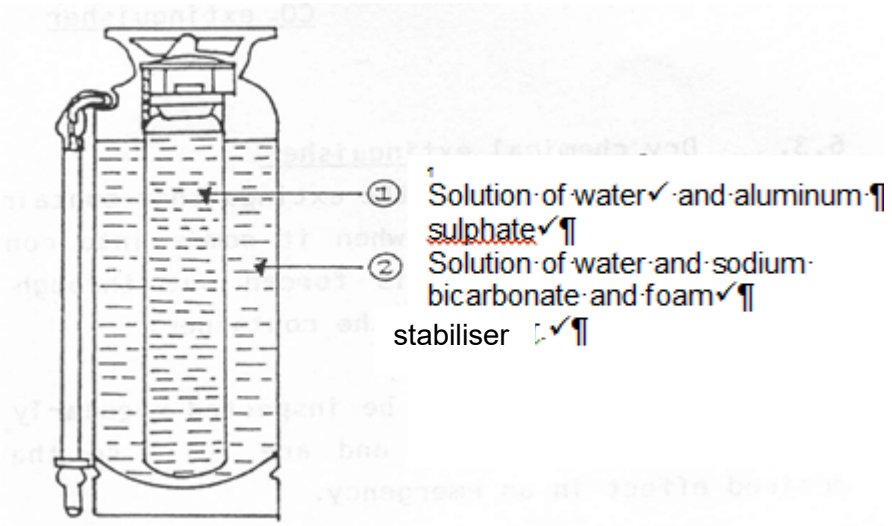
ONE mark for each correct sketch (10)
[20]

QUESTION 5: SAFETY AND STORAGE

5.1
- Fuel
- Oxygen
- Ignition (heat) (3)

5.2
- The container temperature must be kept under control to maintain the pressure within limits.
- Water sprayers must be installed for container cooling if temperatures exceed a maximum.
- A vapour space above the liquid should be maintained to provide enough space for liquid expansion.
- Prescribed firefighting equipment must be available.
- Containers are normally white to prevent heat absorption. (5)

5.3



ONE mark for correct sketch

This type must be used upside down.✓ The handle is turned so that the aluminium sulphate solution in the inner container✓ comes into contact with the sodium bicarbonate (bicarbonate of soda),✓ reacts and releases the foam.✓ The foam forms its own high pressure and blows out of the nozzle.✓ (10)
[18]

TOTAL: 100

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